Charles T. Force
Associate Administrator for
Space Communications
NASA
Washington, DC 20546-0001

Paul J. Fox, P.E.
Telecommunications Directions
1000 Connecticut Avenue, NW
Suite 9
Washington, DC 20036

Michael R. Gardner, Esq.
Charles R. Milkis
Rafael G. Prohias
Law Offices of Michael R.
Gardner, P.C.
1150 Connecticut Avenue, NW
Suite 710
Washington, DC 20036
Counsel for:
CellularVision

David B. Giguere
Manager, Radio Programs
Communications Products Business
Unit
Hughes Aircraft Company
Building 232/Mail Stop 8
P.O. Box 2999
Torrance, CA 90509-2999

Stephen L. Goodman, Esq.
Melanie Haratunian, Esq.
Halprin Temple & Goodman
1100 New York Avenue, NW
Suite 650
Washington, DC 20005
Counsel for:
Avant-Garde Telecomm., Inc.

Todd D. Gray
Kenneth D. Salomon
Dow, Lohnes & Albertson
1255 Twenty-Third Street, NW
Suite 500
Washington, DC 20037
Counsel for:
Amer. Council on Educ.; Amer. Assoc. of Community Colleges; California State Univ., Sacramento; Education Network of Maine; State of Wisconsin Educational Communications Board; Univ. of Wisconsin System

M. G. Heavener
MTC Communications
Box 2171
Gaithersburg, MD 20886

Saburo Inui
Vice President
Toyota Motor Corporate Services
of North America, Inc.
1850 M Street, NW
Washington, DC 20036

John P. Janka
Raymond B. Grochoski
Latham & Watkins
1001 Pennsylvania Avenue, NW
Suite 1300
Washington, DC 20004
Counsel for:
Hughes Communications Galaxy, Inc.

George M. Kizer, Chairman
Denis Couillard, Vice Chairman
Eric Schimmel, Vice Pres. of TIA
Telecommunications Industry Assoc.
2500 Wilson Blvd., Suite 300
Arlington, VA 22201

Ikuya Kobayashi
Managing Director
Vehicle Electronics Division
Fujitsu Ten Ltd.
1-2-28 Gosho Dori
Hyogo-Ku, Kobe 652
Japan

Thomas E. Kolgo
Manager, Communication Systems
Communications & Electronic
Systems
Texas Instruments Incorporated
P.O. Box 650311
Dallas, Texas 75251

Andre J. Lachance
GTE Service Corporation
1850 M Street, NW
Suite 1200
Washington, DC 20036

Mitchell Lazarus, Esq.
Arent Fox Kintner Plotkin
& Kahn
1050 Connecticut Avenue, NW
Washington, DC 20036
Counsel for:
Endgate Technology Corporation

Norman P. Leventhal
Raul R. Rodriguez
Stephen D. Baruch
Leventhal Senter & Lerman
2000 K Street, NW
Suite 600
Washington, DC 20006
Counsel for:
TRW Inc.

Ronald D. Maines
Maines & Harshman, Chrtd.
2300 M Street, NW
Suite 900
Washington, DC 20037
Counsel for:
GHz Equipment Co., Inc.

Cathleen A. Massey, Esq.
Vice President -- External Affairs
McCaw Cellular Communications, Inc.
1150 Connecticut Avenue, NW
Suite 400
Washington, DC 20036

Robert J. Miller, Esq.
Gardere & Wynne, LLP
3000 Thanksgiving Tower
160 Elm Street
Dallas, Texas 75201
Counsel for:
Alcatel Network Systems, Inc.

Lawrence J. Movahin
Wilkinson Barker Knauer & Quinn
1735 New York Avenue, NW
Washington, DC 20006-5289

Philip V. Otero
Alexander P. Humphrey
GE American Communications, Inc.
1750 Old Meadow Road
McLean, VA 22102

Richard D. Parlow
Associate Administrator
Office of Spectrum Management
United States Department of Commerce
NTIA
Washington, DC 20230

George Petrutsas
Fletcher Heald & Hildreth, PLC
1300 North 17th Street
11th Floor
Rosslyn, VA 22209
Counsel for:
Matsushita Communications Industrial Corporation of America

Leonard R. Raish
Fletcher Heald & Hildreth, PLC
1300 North 17th Street
11th Floor
Rosslyn, VA 22209
Counsel for:
Harris Corporation-Farinon Division

Mark C. Rosenblum
Kathleen F. Carroll
Ernest A. Gleit
AT&T
Room 3261B3
295 North Maple Avenue
Basking Ridge, NJ 07920
Counsel for:
AT&T

Linda C. Sadler
Manager, Governmental Affairs
Rockwell International Corporation
1745 Jefferson Davis Highway
Suite 1200
Arlington, VA 22202

Peter B. Teets
President, Martin Marietta Space Group
Martin Marietta Corporation
6801 Rockledge Drive
Bethesda, MD 20817

Yoshikuni Toko
General Manager
Radio & Satellite Communications Div.
Fujitsu Ltd.
1015, Kamikodanaka
Nakahara-ku, Kawasaki
JAPAN, 211

James P. Tuthill
Betsy Stover Granger
140 New Montgomery Street
Room 1525
San Francisco, CA 94105
Counsel for:
Pacific Bell Mobile Services;
Telesis Technologies Laboratory

Rory Van Tuyl
Hewlett-Packard Company
Laboratories
3500 Deer Creek Road
Palo Alto, CA 94303-0867

Richard S. Wilensky, Esq.
Middleberg Riddle & Gianna
2323 Bryan Street
Suite 1600
Dallas, Texas 75201
Counsel for: ComTech Associates, Inc.

James L. Wurtz
1275 Pennsylvania Avenue, NW
Washington, DC 20004
Counsel for:
Pacific Bell Mobile Services;
Telesis Technologies Laboratory

Eileen O'Hara
Eileen O'Hara

* By Hand Delivery

APPENDIX A

desic

Apples-to-Apples Comparison Demonstrates the Feasibility of LMDS Above 40 GHz

Prepared by

Teledesic Corporation

2300 Carillon Point
Kirkland, Washington 98033

(206) 803-1400
Fax (206) 803-1404

March 1, 1995

Apples-to-Apples Comparison Demonstrates the Feasibility of LMDS Above 40 GHz

This paper addresses some of the technical misleading and inaccurate technical representations made by CellularVision in their comments[1]. A partial summary of CellularVision's mis-statements and the corresponding technically correct statements are provided in the following table. **<u>The obvious conclusion is that LMDS is feasible in the 40.5 - 42.5 GHz band.</u>** The remainder of this paper provides support for this statement.

<u>CellularVision Representation</u>	**<u>Correct Technical Statement</u>**
LMDS service above 40 GHz would cost 30 to 40 times as much as 28 GHz LMDS.	**LMDS service above 40 GHz will cost about the same as 28 GHz LMDS.**
LMDS operation above 40 GHz will require a minimum of 7 times as many cells.	**LMDS operation above 40 GHz will require the same number of cells as 28 GHz LMDS.**
40 GHz LMDS transmission equipment cost is double the 28 GHz cost.	**40 GHz LMDS transmission equipment cost is similar to 28 GHz cost.**
No 40 GHz MVDS systems in Europe due to cost/performance problems.	**There are no operational 40 GHz MVDS systems in Europe yet because the standardization specifications were only completed in September of 1993.**
European 40 GHz MVDS was conceived for the low-rain-rate European climate.	**European 40 GHz MVDS was conceived for the European climate which has rain rates similar to those in the U.S.**
Europe acknowledges severe 40 GHz system range/coverage problems.	**The European MVDS Working Group did not anticipate any range/coverage problems.**
European MVDS working group admits frequency reuse problem at 40 GHz.	**The European MVDS Working Group did not anticipate any frequency reuse problem at 40 GHz.**
Propagation losses at 40 GHz force inefficient channel spacing.	**The same channel spacing can be used in the 40 GHz band as in the 28 GHz band.**
Satellite spectral efficiency is maintained above 40 GHz but LMDS at 40 GHz requires four times as much spectrum.	**Spectral efficiency is maintained above 40 GHz for both satellite and LMDS.**
LMDS above 40 GHz likely to require 4 times as much spectrum as 28 GHz.	**LMDS above 40 GHz will require the same amount of spectrum as at 28 GHz.**

[1] Comments of CellularVision, LMDS is not Viable in the Frequency Bands Above 40 GHz, (filed January 30, 1995) ("CVNY Paper").

LMDS SERVICE ABOVE 40 GHZ WILL COST THE SAME AS 28 GHZ LMDS

CellularVision is wrong, 41 GHz LMDS service will not cost 30 to 40 times the cost at 28 GHz. It will not cost 14 times the cost at 28 GHz. It will not cost 7 times the cost at 28 GHz. It will not even cost 2 times the cost at 28 GHz. It may initially cost 2% more, but even then over time it will cost the same as 28 GHz LMDS service.

CellularVision Does not Provide Any References to Support Its Technical Statements

CellularVision argues that "Operation of the LMDS system above 40 GHz results in a direct increase [of] system cost by a factor of thirty to forty (30 to 40)."[2] CellularVision does not provide any factual information to support its claim, rather, they use unsubstantiated guesses and mis-information. In fact, CellularVision's 21 page appendix , "LMDS is Not Viable in the Frequency Bands Above 40 GHz", does not provide even one reference to support any of its technical statements, or more accurately, mis-statements.

CellularVision's Comparisons are Biased

CellularVision provides link budgets[3] that purport to provide an apples-to-apples comparison of 28 GHz and 41 GHz LMDS systems. CellularVision even states that "this is necessary to make the comparison valid and to fully bring to light any benefits or penalties which may result due to operation of the LMDS system at 40 GHz."[4] In reality CellularVision's comparison is apples-to-oranges. Three obvious system differences are highlighted in the following table.

	28 GHz	41 GHz
Transmit Power for 50 Channels	20 Watts	9 Watts
Transmit Antenna Coverage	5° elevation coverage	6.3° elevation coverage
Receive Antenna Diameter	7.5"	5.5"

[2] CVNY Paper, at 4.
[3] CVNY Paper, at 5, Table 1.
[4] CVNY Paper, at 5.

Collectively, these difference result in penalizing the 41 GHz system by 7.5 dB. CellularVision uses these biased results to claim that LMDS systems can only operate with 1.15 mile radius cells at 41 GHz as opposed to 3 mile radius cells at 28 GHz. This is the basis of their claim that 7 times as many cells would be required for 41 GHz operation.

A true apples-to-apples comparison, as provided in Teledesic's comments, shows that for identical hub antenna coverage, for identical transmit power, for identical cell size, and for identical subscriber antenna diameters, a 41 GHz LMDS system operating in New York City provides 99.75% rain availability. This is better rain availability then Hughes' commercially successful DIRECTV service. Thus **an economically viable 41 GHz LMDS system requires exactly the same number of cells as a 28 GHz system**. An apples-to-apples comparison in shown in the following table.

Honest Link Budgets for LMDS Operation at 28 GHz and 41 GHz

System Parameter	28 GHz System	41 GHz System
Power Transmitter	+20 dBW	+20 dBW
7 dB linearity backoff	+13 dBW	+13 dBW
50 channel factor (-17 dB)	-4 dBW/channel	-4 dBW/channel
Transmitter line loss	-5 dBW/channel	-5 dBW/channel
Transmit antenna gain	+7 dBW EIRP/channel	+7 dBW EIRP/channel
Maximum range	3 miles / 5 km	3 miles / 5 km
Rain Availability	99.9%	99.7%
Path Loss	-148.4 dB @ 28 GHz	-150.7 @ 41 GHz
Receive Antenna Gain	+32 dBi	+35.3 dBi
Received carrier level	-109.4 dBW/channel	-107.4 dBW/channel
Receiver noise figure	6 dB	6 dB
Receiver noise level (18.8 MHz bandwidth)	-125.4 dBW/channel	-125.4 dBW/channel
Carrier to noise ratio	16 dB	16 dB
Video SNR	45 dB	45 dB
Picture "Q' rating	3.8	3.8

CellularVision's Cost Estimates are Unsupported and Deceptive

CellularVision then goes on to argue that 41 GHz LMDS transmission equipment will cost double that of 28 GHz equipment. This is an extremely misleading argument. Their argument is supported by statements like

- "the cost [of TWTAs] is projected to be nearly double the cost of ... 28 GHz [TWTAs]"[5]
- "even with an allowance for doubling the cost of the antenna"[6]
- "the cost of the down converter is expected to be a minimum of 75 percent higher, with a cost increase factor of more than 100 percent likely"[7]

CellularVision provides no support for these dubious statements. A reputable equipment manufacturer, with an obvious interest is supplying equipment to LMDS operators, Endgate Technology Corporation, has stated in its comments that "Opening the 40 GHz band would result in slightly higher-cost millimeter wave equipment (as compared to 28 GHz equipment) ... Initially this will result in 40 GHz transmit and receive equipment on the order of 15% to 20% more expensive then equivalent 28 GHz equipment. Endgate further states that "Over a period of time this price differential will become insignificant in much the same way as the price differential between C-band and Ku-band systems has declined."[8]

Regardless of the possible cost differences between 41 GHz and 28 GHz millimeter wave components, CellularVision's argument is deceptive. The real issue is the total cost of the transmitter station. The modulators, IF equipment, encoders, power supplies, equipment racks, site cost, and the equipment required to distribute programming to the hub are identical for both 41 GHz and 28 GHz operation. Even assuming that the millimeter wave components accounted for 10% of the transmitter

[5] CVNY Paper, at 6.
[6] CVNY Paper, at 6
[7] CVNY Paper, at 7
[8] Endgate comments at 5

station cost and using CellularVision's unsubstantiated estimate of a 100% cost increase for these components, the total transmitter station cost would increase by only 10%. Using Endgate's more realistic estimates for the millimeter wave components suggests an initial total cost increase of only 2%, decreasing to 0% over time.

CellularVision makes a similarly misleading argument with regard to the subscriber receiver unit. They state "... will result in a cost increase relative to the 28 GHz receiver of 75 to 100 percent." Again, the real issue is the total cost of the subscriber unit and only a small fraction of the components, specifically the antenna and the low-noise blockconverter (LNB), are impacted when changing from 28 GHz to 41 GHz operation. The IF, demodulators, decoders, power supply, case, and user interface are identical for both 28 GHz and 41 GHz operation. Again, using Endgate's more realistic estimates for the millimeter wave components suggests a small initial total cost increase, decreasing to 0% over time.

LMDS SYSTEMS ARE VIABLE ABOVE THE 28 GHZ BAND

CellularVision argues that "There are no LMDS systems above 40 GHz in the world because they are not viable above the 28 GHz band". This statement exemplifies CellularVision's line of reasoning through out their "technical" paper. Namely, present only selective data, extrapolate the data beyond its reasonable limit, and arrive at far reaching conclusions. Needless to say, these conclusions do not reflect reality but rather serve CellularVision's narrow interest of obtaining a license to operate an LMDS system in New York, based on their "pioneer preference", and building an LMDS system based on their "patented" technology. In this section additional information is provided about a 40 GHz MVDS system in Europe. This information corrects and completes the comments that CellularVision has provided. Conclusions can then be drawn about the feasibility of LMDS at 40 GHz that are based on facts.

CellularVision argues that although bands above 40 GHz have been authorized for years in Europe for MVDS, which is similar to LMDS, there is no known 40 GHz systems currently in operation. This argument is flawed in two respects. First, although the use of 40 GHz band was first authorized in 1990, the specification for the analog MVDS system was not completed until September of 1993 [1]. Second, the relevant issue is not when the 40 GHz band was first allocated for MVDS application, the important issue is the current status and the future plans of MVDS in this band. Sometimes the development of the hardware for the system implementation requires a period of time following approval of a specification for a new service. The fact that the 40 GHz band has been allocated for LMDS type services for four years or longer is not the relevant issue. The issue is whether today MVDS at 40 GHz is a viable option from both the technical and economical point of view.

Investments in the 40 GHz Equipment Over the Last Several Years Makes LMDS at 40 GHz Feasible

Over the last several years, a tremendous engineering effort has been devoted towards designing the MVDS at 40 GHz. As a result of this on going effort and investment of millions of dollars in equipment development, and in experimental work at 40 GHz, the implementation of MVDS in this band is now feasible. CellularVision in its comments makes vague statements such as "The technical shortcomings of potential systems for operation in the bands above 40 GHz are obvious to system designers. " inputs that LMDS is not feasible above the 40 GHz. The natural question that is raised by this inference whether all the investments made in developing MVDS above 40 GHz been wasted, and whether the companies that invested and worked in this frequency band have abandoned their plans and are now actively pursuing other systems. The answer is clear, the investment in this band has paid off. Companies such as Eurobell have applied for and have obtained the license to deploy and operate MVDS at 40 GHz band in Europe. Companies such as Philips Microwave and GEC Plessey have developed equipment that makes the implementation of MVDS possible at 40 GHz and they continue to invest in improving their existing hardware.

CellularVision is right in asserting that five years ago the technology to implement an LMDS system at 40 GHz was not mature. But the important fact is that as a result of many years of engineering effort and investment of millions of dollars, equipment is now available which make the implementation of an LMDS system feasible at 40 GHz.

MVDS Development in Europe Demonstrates the Feasibility of LMDS at 40 GHz in U.S.

CellularVision asserts that even if 40 GHz system were deployed in Europe in the future, their planned architecture and specification would preclude their role as an effective broadband cable competitor in the U.S.. The reason for this statement, according to CellularVision, is that for the same percentage availability, the rain rates in

Europe are much less than the rain rates in the U.S.. However, the fact is that, except for a small part of south eastern U.S., the rain rates for Europe are comparable to the rain rates in the U.S.. The confusion arises from the fact that CellularVision compares the rain rates in Europe for 99.7% availability with the rain rates in the U.S. for 99.9% availability. This is yet another apples-to-oranges comparison by CellularVision.

CellularVision incorrectly states that "Rain rates in western Europe for 99.9% availability are in the range of 3 to 7 mm/hour."[9] The Global Model for rain attenuation prediction, also known as the Crane Model, shows that the rain rates in western Europe for 99.9% availability are in the range of 5.2 - 22 mm/hour. The following table provides a breakdown by country.

	Rain Rate for 99.9% Availability (mm/hour)
France	7.2 - 14.5
Ireland	7.2
Italy	9.8 - 22
Portugal	7.2 - 9.8
Spain	5.2 - 9.8
United Kingdom	7.2

The Global Model shows that in the United States, the rain rates for 99.9% availability are in the range of 4.2 - 35 mm/hour. Thus the rain rates in the United States are no more then 60% greater then those in Western Europe. In fact if Florida and parts of South Carolina, Georgia, Alabama, Mississippi, Louisiana, Arkansas, and Texas are not considered then the range is reduced to 4.2 - 22 mm/hour. This is essentially the same range as for Western Europe. It should be noted that CellularVision's system is designed for New York's rain rate and hence this system does not provide the same availability as in New York in the Southeastern United States. For the eleven Western States, the range is 4.2 - 7.2 mm/hour. This is less than the range in Western Europe

[9] CVNY Paper, at 12

by up to 67%. CellularVision's claim that the rain rates in the United States are "two to five times higher than the rates in Europe"[10] is false. This is another example of CellularVision's attempt to mis-lead the Commission.

Two Way Interactive LMDS is Feasible at 40 GHz

CellularVision, in its comments, selectively quotes from the report of the 40 GHz MVDS Working Group [1]. For example, CellularVision reports that the MVDS Working Group has concluded that the potential for two way interactive LMDS in the bands above 40 GHz is bleak. It should be noted that the MVDS Working Group has only addressed the system specification for an analog one-way MVDS system, and hence the design of a back channel was not considered in detail. However, since the publication of the specification for analog MVDS, the 40 GHz Working Group has re-convened to address the requirement for specification for licensing digital MVDS and the requirements for MVDS interactive back-channel. Values of between 64 kBits/s and 128 kBits/s has been considered for back channel to allow for interactively and telephony.

Equipment for LMDS Implementation at 40 GHz is Available

The MVDS Working Group equipment guidelines were developed based on 1991 technology. As a result of the on-going investment in 40 GHz technology over the past several years, the performance of 40 GHz components has improved considerably. For example, the MVDS Working Group specified the transmitter power guideline of 200 mW per channel based on a review of the solid state and traveling wave tube amplifier state-of-the-art in 1991. By 1996 transmit powers of up to 1W per channel will be achievable using pseudo-morphic HEMT devices [2]. This also demonstrates that Texas Instruments' comment that "Solid state power generation that is available with today's technology ....is ....0.01 Watt at 40 GHz" is false and self-serving. .Similarly, the MVDS projection of 9 dB receiver noise figure for preamplifiers has been surpassed by

---

[10] CVNY Paper, at 12

today's PHEMT devices which provide a noise figure of 5 dB noise figures (see data sheet attachment

Another issue that has been raised by CellularVision is the "limitation of frequency reuse" at 40 GHz "because of sidelobe suppression, cross polarization,....". The MVDS Working Group in their report suggest that at a rain rate of 25 mm/h, the rain-induced cross-polarization discrimination would be of the order of 25 dB for a 5 km path, which is about 7 to 10 dB better than the worst case (off bore-sight) values for antenna XPD. Rain induced XPD is therefore not expected to be a problem. Several propagation experiments are currently being carried out by Ratherford Appleton Laboratory (RAL) and University of Essex to determine other propagation characteristics at 40 GHz in different regions. In contrast, CellularVision has not undertaken any extensive propagation experiments which show the propagation characteristics of the 28 GHz band in different regions. **CellularVision's narrow interest is in the deployment of an LMDS system in New York. Its comments selectively quote paragraphs out of context from technical documents and build a case that serves its need.**

MVDS Frequency Plan is designed to Maximize Commonality with Satellite Services

CellularVision also asserts that the propagation losses at 40 GHz have forced MVDS to select inefficient channel spacing. CellularVision concludes that "The 26 MHz bandwidth is required to achieve additional FM improvement gain in the demodulator over the U.S. FM bandwidth of 20 MHz because the additional gain is needed to achieve even a minimally acceptable range in the European climate for one-way MVDS service." **This is yet another misrepresentation of MVDS by CellularVision. The specification, MPT 1550, has been drafted by the MVDS Working Group to provide maximum commonality between MVDS and satellite Direct-To-Home (DTH) receivers.** The channel spacing proposed by MVDS therefore exploits maximum commonality with DTH indoor receiver units by using them as a basis for MVDS receivers. This then has defined the co-polar channel spacing at 29.5 MHz interleaved with cross-polar channels from the other channel groups to be used in adjacent service areas at 14.75 MHz, with the channel bandwidth set at 26 MHz. The MVDS Working Group decision for the channel spacing was based on providing a low cost readily available indoor receiver unit utilizing the existing in door DTH receiver.

Development of Digital MVDS Takes Advantages of the Latest Technology in Digital Compression to Achieve Efficient Use of Spectrum

Since the initial development of the analog MVDS specification, great progress has been made in digital compression techniques. It is therefore expected that the majority of Direct Broadcast Satellite services and cable will adopt the MPEG-2 digital format in the 1995 to 1996 time frame. The MVDS Working Group is currently developing the specification for a digital system. One approach being considered is to treat each analog FM channel as a broadband multiplexed datastream. Typical MPEG-2 compression results in data rates of between 2 MBits/s and 6 MBits/s for typical entertainment channels. Therefore a 24 MBits/s of data can include from 4 to 12 channels of programming. This data can then be transmitted at the 29.5 MHz channel spacing, resulting in total of 128 (4x32) to 384 (12x32) programming channels. The MVDS Working Group is realizing that the FM system is the technology of the past, and future systems will need to rely on efficient use of spectrum through employment of digital techniques. In this respect, CellularVision's FM system represent an outdated, archaic system.

Spectrum Allocation Considerations

CellularVision offers a collection of loosely related facts and statistics[11] in support of their conclusion that LMDS is going to satisfy the demands of the Information Age while protecting us all from the evil monopolies of the telephone, cable and satellite industries. Their paper ignores what has, and always will be, the fundamental issue behind this debate: that **28 GHz is internationally authorized for Fixed Satellite Services (FSS) and for the United States to unilaterally authorize an incompatible service in that band would prevent the development of a global broadband FSS system. Such action will cripple an essential component of the National Information Infrastructure and the Global Information Infrastructure.**

Radio spectrum is a precious, natural resource and its allocation should not be taken lightly. As an influential member of the International Telecommunications Union and a worldwide economic and technology leader, the United States has both a domestic and international responsibility to judiciously allocate that resource in a way that is fair and will extend the benefit of that resource to the meet the greatest need. **To deprive the world of access to an advanced digital network at the expense of an inherently local system would be unfortunate and irresponsible.**

CellularVision states that, "we [society] have developed great concepts of interactivity and information access but are unable to deliver the *promised land* to industry, education and medical operations, or residences because of the lack of available low-cost, high-bandwidth distribution systems."[12] Are we to conclude from CellularVision's comments that the *promised land* should only be available to those people who live in high-density areas with a large enough population to support investment in LMDS infrastructure? **This type of thinking only widens the gap between the information haves and have nots.**

[11] CellularVision comments, "Spectrum Allocation Considerations", ("Appendix 3")
[12] paragraph 3 of Appendix 3

CellularVision goes through several calculations to determine that satellite service does not have adequate capacity to address the 90% of the population living in 10% of the land mass of the U.S.[13] Assuming for the sake of discussion this is true, areas of high density are best served by current and planned broadband, wireline access services. It is in these dense areas where the economics of wireline are most favorable. As population density falls off, so does the economics of wireline access. **Given CellularVision's argument, 80% of the land mass and 10% of the U.S. population would never have access to advanced digital networks and the economic and social benefits associated with access to these advanced services.**

The CellularVision paper contains many references to the Information Age, the Global Information Infrastructure and how the LMDS system supports such concepts. Yet, the CellularVision system, as designed, without any back channel capacity does anything but that. Even if the CellularVision system was, indeed, a two-way broadband system, it is architecturally incompatible with one of the major principles of the Information Revolution: universal access independent of location. The Information Revolution unlike the Agricultural and Industrial Revolutions promises to free people from the need to be in close proximity to major centers of infrastructure. Because of the nature of its architecture, the LMDS system is only able to economically serve high-density population areas and, as such, proliferates the old paradigm requiring proximity to infrastructure. **As economic prosperity and the general quality of life become increasingly tied to access to advanced digital networks, depriving any of this country's population from access to this improved quality of life is diametrically opposed to a fundamental goal of the National and Global Information Infrastructure initiatives: universal access.**

[13] paragraph 7 of Appendix 3

CellularVision accuses the telephone, satellite and cable monopolies of both delaying entry of competitors and conspiring to confine the American population to the "low-bandwidth, low resolution technology" of today[14]. First of all, to say there is a monopoly in any of these industries is preposterous. All one has to do is watch television to see the competition for long distance, cellular and now, even local loop services. The cable industry has been concerned by the obvious success of Direct TV and new entrants Echostar and Primestar are poised to enter the market later this year. Likewise, the satellite industry with several providers of VSAT services, competing little LEO data services and the recent licensing of 3 "Big-LEO" systems for voice services should be evidence enough that no monopoly exists. Oddly enough, **CellularVision is quick to cry foul against the so-called monopolies, yet one of their biggest investors, Bell Atlantic, is a member of the club they criticize**.

CellularVision criticizes all existing and proposed forms of communications infrastructure as falling short on their ability to meet the demands of National and Global Information Infrastructure. In fact, their statement that, "LMDS at 27.5-29.5 GHz offers competition to the two major entrenched monopolies: cable and telephony"[15], couldn't be further from the truth. First and foremost, the CellularVision system is a one-way, point-to-multi-point system with no viable back channel capability. To compare LMDS, as proposed, with a two-way, broadband, symmetric communication systems is absurd. Current CellularVision trials have not demonstrated a realistic way of achieving viable 2-way communication with their present architecture. **For CellularVision to provide broadband back channel capability would require major system design modifications to allow line-of-site, and perhaps, even smaller cell sizes. Such modifications are both consistent and compatible with 40 GHz requirements.**

---

[14] paragraph 8 and conclusion of Appendix 3
[15] conclusion of Appendix 3

In conclusion, **CellularVision has put forth an *apples to oranges* comparison**. The 28 GHz band is internationally allocated for FSS systems. The systems proposed to date by Hughes and Teledesic are global, broadband, interactive and based on the latest digital technologies. These systems provide access and capability not presently available by any other means. On the other hand, CellularVision's proposed system is a one-way, video distribution system employing analog technology, providing services for which several alternatives already exist (cable, wireless cable, network broadcast, direct broadcast and, in the near future, video dialtone) and is economically viable only in those areas with high population density. **To deprive the world of the benefits afforded by the proposed interactive, broadband systems in favor of a local one-way system for which many alternatives exist today, would be an unfortunate setback to the formation of the Global Information Infrastructure and a waste of a precious natural resource: radio spectrum.**

REFERENCES

[1] MPT 1550 Performance Specification for Analogue Multipoint Distribution Systems (MVDS) Transmitters and Transmit Antennas Operating in the Frequency Band 40.5 - 42.5 GHz. (Radiocommunication Agency)

[2] Ian Clarke, Business Development Manager, Phillips Microwave, "Microwave Video Distribution Systems - The 1994 Position", Report to 40 GHz MVDS Working Group, December 1995

[3] Litton Solid State GaAs MMIC Amplifier, LMA142, Data Sheet.

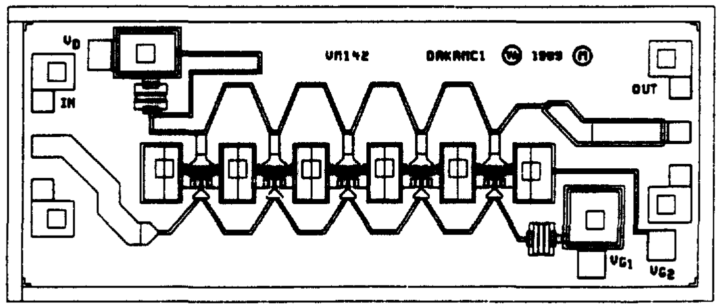
Litton Solid State

LMA142

GaAs MMIC Amplifier

Features

Frequency: 10-50 GHz
Small Signal Gain: 7 dB
SSG/Frequency: ± 1.5 dB
Noise Figure: 4.5 dB
Pout @ -1 dB: +8 dBm
VSWR Input: 2.5:1
VSWR Output: 2.5:1
Chip Size: .039 x .095 x .004 inch



Description

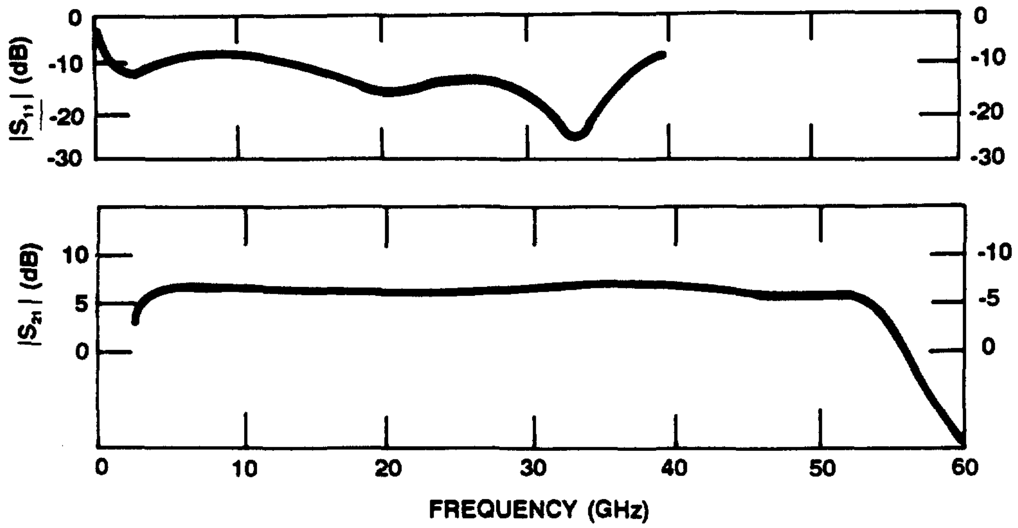
The Litton LMA142 is a 10-50 GHz AlGaAs/GaAs PHEMT monolithic cascade distributed low noise amplifier designed for low noise gain block, and gain control applications.

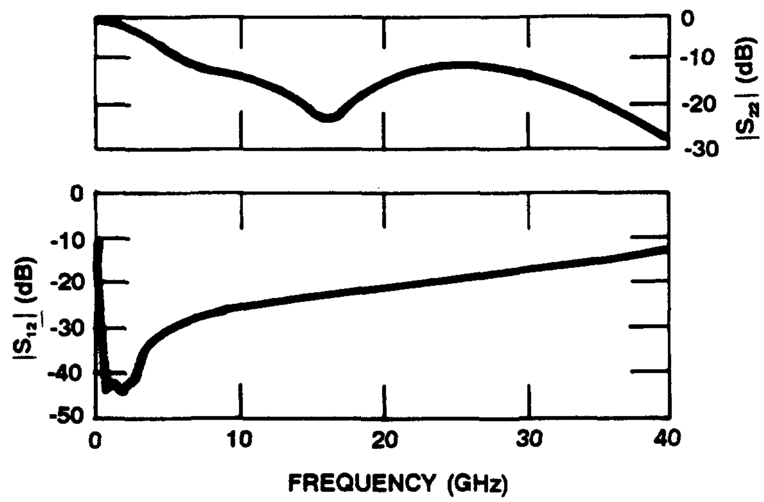
Electrical Specifications at T_A = 25°C

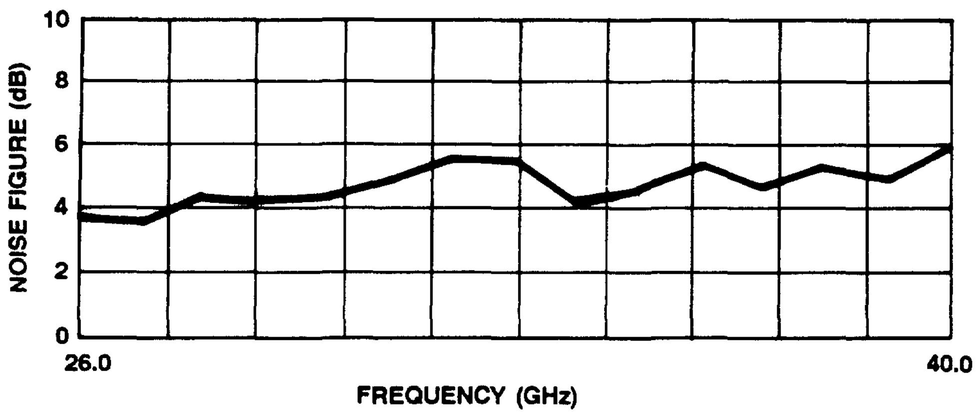
Symbol	Parameter	Test Conditions	Limit Min.	Limit Typ.	Limit Max.	Unit
Freq.	Operating Frequency Range	Vds = 3V	10		50	GHz
Idss	Saturated Drain Current	Ids = 1/2 Idss	60	100	150	mA
|S21|	Small Signal Gain	Vg2 = 2V	6	7		dB
Δ G	Gain Flatness			± 1	± 1.5	dB
NF	Noise Figure			4.5	6	dB
VSWR (In)	Input VSWR			2.0:1	2.5:1	
VSWR (Out)	Output VSWR			2.0:1	2.5:1	
P-1dB	Power Output @ -1 dB Point		6	8		dBm
|S12|	Reverse Isolation		13	15		dB

Notes:
1. All devices are 100% DC and RF probed (S-Parameters up to 40 GHz Only)
2. Specifications are subject to change without notice

Typical Device Characteristics







AFFIDAVIT OF FARZAD GHAZVINIAN

I, Farzad Ghazvinian, being duly sworn, do depose and state as follows:

1. I am an electrical engineer specializing in Communication Systems Engineering, working for Teledesic Corporation. Additional information concerning my engineering background and activities is shown in Attachment A hereto.

2. I prepared with Mark A. Sturza the Engineering Exhibit which is attached to the foregoing Comments of Teledesic Corporation in the matter of Amendment of Parts 2 and 15 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications. Except for those factual matters of which official notice may be taken or which are matters of public record, the statements made in that engineering exhibit are true, complete and correct to my personal knowledge.

Date: 2/28/95

FARZAD GHAZVINIAN

Subscribed and sworn before me this 28th day of February, 1995

JILL L. READER
COMM. # [illegible]
Notary Public — California
LOS ANGELES COUNTY
My Comm. Expires DEC 1, 1998

Jill L Reader
NOTARY PUBLIC

My commission expires 12-1-1998

Affidavit of Dr. Farzad Ghazvinian
Attachment A

The following is a supplement to the affidavit of Dr. Farzad Ghazvinian, 5110 W. Goldleaf Circle, Suite 330, Los Angeles, CA 90056, Telephone Number (213) 293-3001.

I, Farzad Ghazvinian, received my B.Sc. Degree in Electrical Engineering from London University (London, England) in 1975, my MSEE from the University of California, Los Angeles in 1976, and my Ph.D. from the University of Southern California (Los Angeles, California) in 1981.

From 1995 to present, I have been employed by the Teledesic Corporation as Director of Communications Systems.

From 1981 to 1995, I was employed by LinCom Corporation (Los Angeles, California) as Vice President and manager of the Communication Systems Group.

I have supported the NASA Goddard Space Flight Center on many communication system engineering efforts related to Tracking and Data Relay satellite System (TDRSS). I have also performed many feasibility studies for advanced TDRSS concepts and applications in support of NASA space missions.

I have performed many analyses in support of the NASA Johnson Space Flight Center, in connection with the design and performance evaluation of the communication systems of NASA's Space Station and Space Shuttle programs.

I have performed theoretical analysis and computer simulation to enhance the performance of ranging and synchronization systems for satellite and terrestrial networks.

I have performed a feasibility study of a plan to implement a nationwide network of commercial broadcast radio stations for the purpose of emergency data communication.

I have received a Public Service Group Achievement Award from NASA in recognition of my support in the development and application of Communication Link Analysis and Simulation System for NASA space programs.

I am a co-author of many technical papers in the area of communication system analysis and design that have been published in conference proceedings or technical journals.